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GB A 2134206 GB 1196227 GB 1045922  
GB 1301911 GB 1183779 GB 0868161  
GB 1242438 GB 1124687 GB 0794551

(58) Field of search

F2P  
Selected US specifications from IPC sub-classes F16L  
F17C

## (54) Closure

(57) A cylindrical aperture (2) in an annular member (1) can be closed by a circular member (3) having an O-ring (4) mounted in a groove in its periphery. A locking arrangement on the circular member (3) to secure it in the aperture (2) comprises a plurality, for example eight, of arcuate segments (8) which form a substantially complete ring and are mounted on an annular flange (9) of the circular member (3). The segments (8) can be pivoted outwardly to cause them to engage behind a step (6) in the cylindrical aperture (2) by a control arrangement comprising the rods (17) coupled to a stepped carousel which can be rotated by a handle (22).

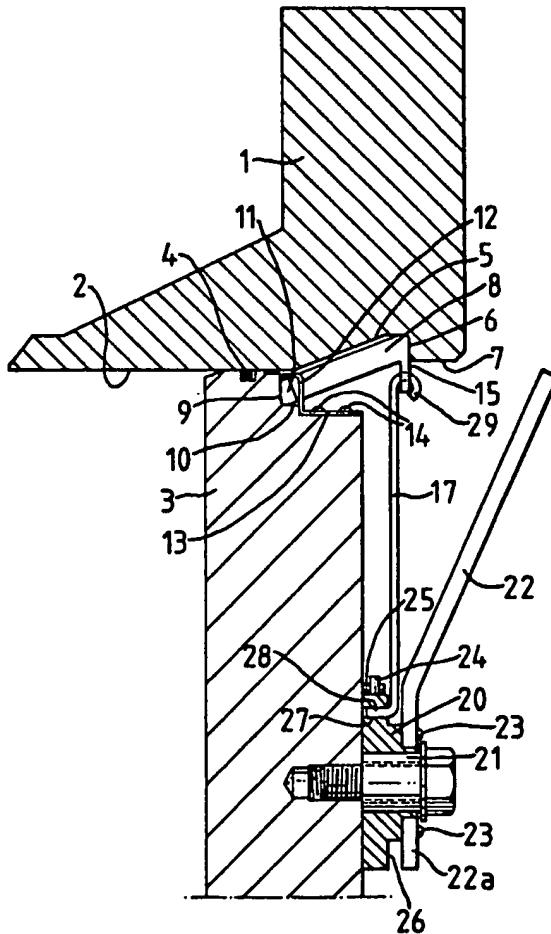


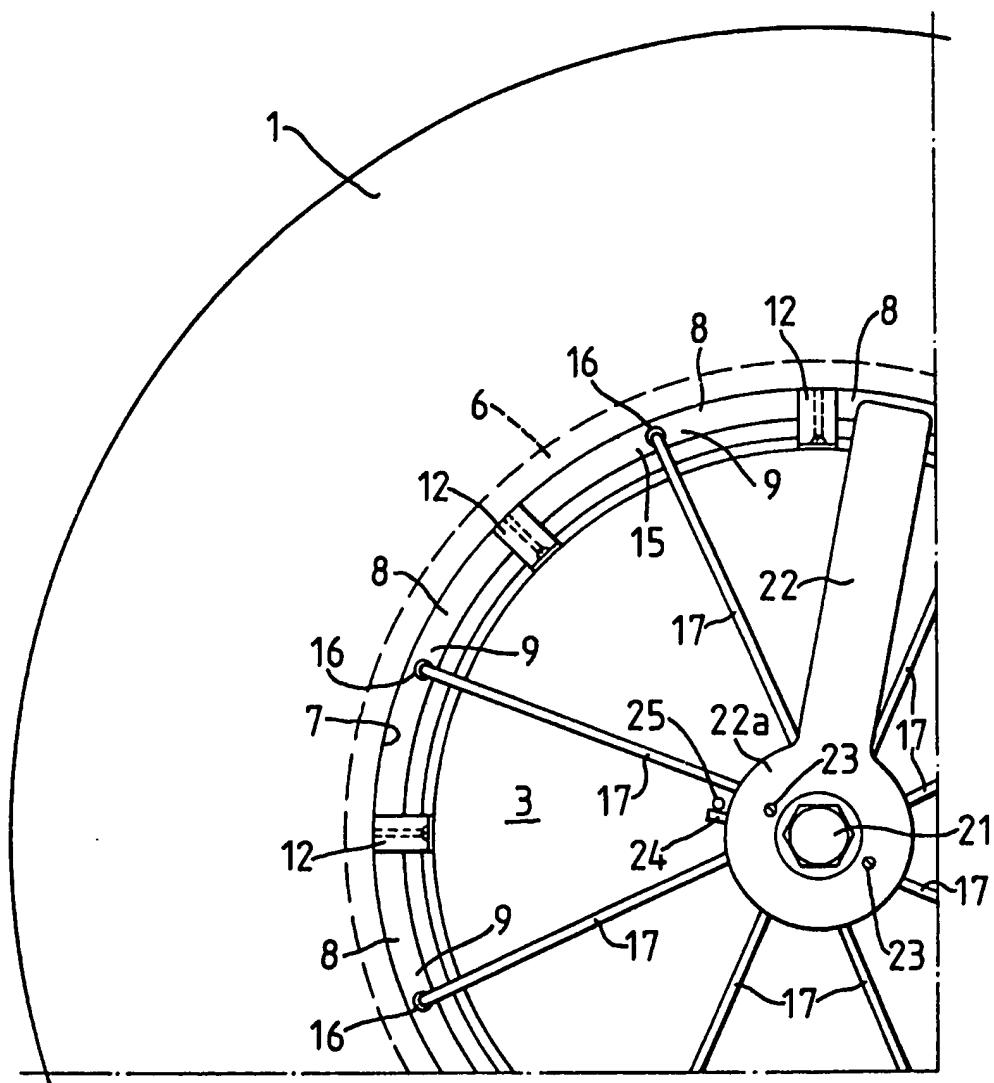
FIG. 2.

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FIG. 1.



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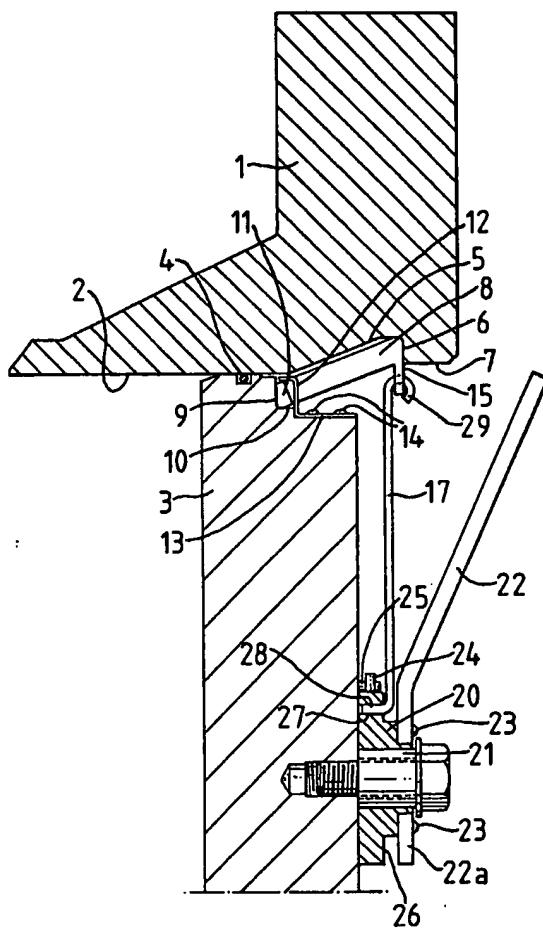


FIG. 2.

FIG. 3a.

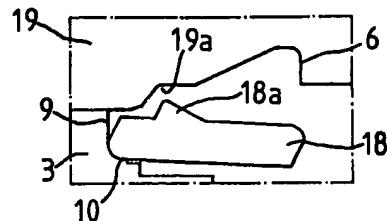


FIG. 3b.

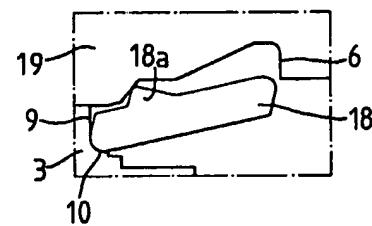


FIG. 3c.

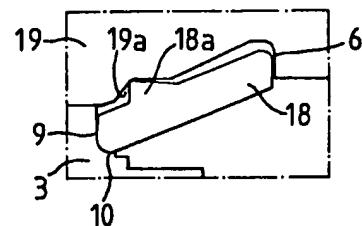
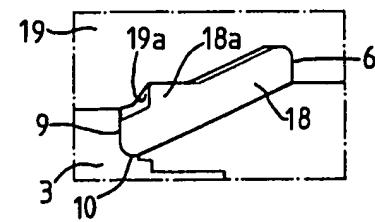


FIG. 3d.



## SPECIFICATION

## Closure

5 The invention relates to a closure and has particular but not exclusive application to a closure which can be quickly opened and which can provide access to the interior of a pressure or vacuum vessel, a pipeline, under-  
 10 sea equipment or other means in which there is likely to be a pressure differential across a closed opening.

Closures for such openings have, of course, been provided in the past, but have been expensive to manufacture and/or cumbersome to operate.

According to the invention a closure comprises a circular member to engage in a cylindrical aperture, which cylindrical aperture has a step in the bore thereof, the circular member carrying a peripheral seal and mounting at least three arcuate segments, pivotably mounted on the circular member and movable outwardly by co-ordinated control means to engage the step in the bore of the cylindrical member and thereby prevent relative axial movement in at least one direction between the circular member and the cylindrical bore.

Advantageously the step in the bore of the cylindrical member is formed by a generally wedge shaped annular recess in the wall of the cylindrical member and is so arranged that the smallest diameter of the step is larger than the portion of the cylindrical member against which the peripheral seal of the circular member engages.

The co-ordinated control means may comprise a plurality of rods extending generally radially of the circular member, each coupled at its outer end to a respective one of the segments and each coupled at its inner end to a control disc which can be rotated to cause radial movement of the rods to move the segments either outwardly or inwardly.

45 The invention is diagrammatically illustrated by way of example in the accompanying drawings, in which:-

Figure 1 is a fragmentary elevation of a member defining a cylindrical aperture with a closure according to the invention engaged therein;

Figure 2 is a schematic sectional view corresponding to Fig. 1; and

Figures 3a, 3b, 3c and 3d show successive stages in the movement of a segment of a closure according to the invention from a released condition to a locking condition.

Referring to the drawings an annular member 1 defines a cylindrical aperture 2 in which a circular member 3 can be engaged as a closure, the circular member 3 having an O-ring 4 mounted in a groove in its periphery to form a seal with the wall of the aperture 2. A locking arrangement is provided on the circular member 3 to secure it in the bore 2. In the

embodiment shown the annular member 1 could be a part of a pressure vessel which in use would have positive pressure therein, the interior of the vessel lying to the left-hand side of the closure member 3 as viewed in Fig. 2.

The bore 2 has an annular recess 5 therein forming a step 6, an outer portion 7 of the bore 2 being of greater diameter than an inner portion thereof with which the O-ring seal 4 is engaged. This facilitates insertion of the circular member 3 in a right to left direction as viewed in Fig. 2. Mounted on the circular member 3 are a plurality, as shown eight, of segments 8 which form a substantially complete ring. An outer portion of the circular member 3 is reduced in diameter to form an annular flange 9 and an annular shoulder 10 with which inner end portions 11 of the segments 8 are permanently engaged. As can be seen in Fig. 1, each segment 8 has its ends reduced and located by a bracket 12 which bridges the gap between that segment and the next segment and locates the two adjacent ends. The brackets 12 are retained on an inner annular shoulder 13 of the circular member 3 by screws 14. Each segment 8 has an inwardly directed flange 15 with an aperture 16 therein which the outer end of a respective tie rod 17 is engaged. By pulling inwardly on the tie rods 17 the segments 8 can be pivoted on their ends 11 to cause the outer ends to be disengaged from the step 6 of the recess 5 in the annular member 1. Conversely by pushing outwardly on the rods 17 the outer ends of the segments 8 can be moved to the position shown in Fig. 2 in which they are fully engaged with the step 6 and lock the closure against outward movement of the circular member 3. Figs. 3a to 4d show successive outward movement of a modified segment 18 into engagement with the step 6 of a modified annular member 19, the segments 18 and the annular member 19 being modified compared with, the segment 8 and the annular member 1 of Figs. 1 and 2 in that a beak 18a is provided on the segment 18 and a recess 19a is provided on the annular member 19 to receive the beak 18a. The pivoting movement of the segment 18 on the flange 9 and shoulder 10 of the circular member 3 is clearly shown in the sequence illustrated in Figs. 3a to 3d as the segment 18 moves from a released position in Fig. 3a to a locked position in Fig. 3d.

The means for causing radially inward and outward movement of the rods 17 are shown in Fig. 2 and comprise a stepped carousel 20 rotatably mounted by means of a bolt 21 on the circular member 3 and mounting a handle 22 secured to the carousel 20 by screws 23 which prevent the handle 22 rotating relative to the carousel 20. A stop 24 on the carousel 20 co-operates with a stop screw 25 engaged 130 in the circular member 3. The carousel 20

includes a lower annular flange 26 with a plurality of apertures 27 therein, in each of which apertures 27 an inner end 28 of a respective one of the rods 17 is engaged, the inner end 28 being turned at right angles with respect to the remainder of the rod. The ends 28 are engaged in the bores 27 before the handle 22 is secured to the carousel 20 by the screws 23 and the handle 22 has a flange 22a which 10 overlies the inner ends of the rods 17 and prevents the turned over ends 28 of the rods 17 becoming disengaged from the bores 27 in the carousel 20. It will be seen from Fig. 2 that the outer ends 29 of the rods 17 are 15 turned back through almost a complete circle to secure them in the apertures 16 in the flanges 15 of the segments 8 and provide a universal type joint. It will be seen that by rotating the handle 22 through an arc of say 20 60° to 90° the rods 17 can be acted upon by the carousel 20 to cause them to move the segments 8 between an outer locked position and an inner released position.

The entire closure shown can be formed 25 relatively cheaply by machining, that is to say special castings and forgings are not required. The circular member for example can be machined from steel plate or formed by machining a standard cover and all the operations 30 required thereon are simple turning or drilling operations, that is to say shaping and milling operations are not required. Likewise the annular member 1 can have the recess 5 formed therein by a simple turning operation. The 35 segments 8 can, if desired, be formed initially as a complete ring with the reduced size end portions being formed before the ring is divided up into the individual segments. The holes 16 can then be drilled and the rods 17 40 engaged therein and bent to shape. The carousel 20 is also a relatively simple item formed by turning and drilling and the handle 22 can be a stamping or pressing.

#### 45 CLAIMS

1. A closure comprising a circular member engaging in a cylindrical aperture, which cylindrical aperture has a step in the bore thereof, the circular member carrying a peripheral seal 50 and mounting at least three arcuate segments, pivotably mounted on the circular member and movable outwardly by co-ordinated control means to engage the step in the bore of the cylindrical member and thereby prevent relative axial movement in at least one direction 55 between the circular member and the cylindrical bore.
2. A closure according to claim 1, in which the step in the bore of the cylindrical member 60 is formed by a generally wedge shaped annular recess in the wall of the cylindrical member and is so arranged that the smallest diameter of the step is larger than the portion of the cylindrical member against which the peripheral seal of the circular member engages.

3. A closure according to claim 1 or claim 2, in which the co-ordinated control means comprises a plurality of rods extending generally radially of the circular member, each coupled at its outer end to a respective one of the segments and each coupled at its inner end to a control disc which can be rotated to cause radial movement of the rods to move the segments either outwardly or inwardly.
- 70 4. A closure according to any one of claims 1 to 3, in which each of the arcuate segments is pivotally mounted on the circular member by engaging an annular shoulder and an annular flange of the circular member.
- 80 5. A closure according to any one of claims 1 to 4, in which the arcuate segments form a substantially complete ring.
6. A closure according to claim 5, in which end portions of the arcuate segments are of reduced section and brackets are provided to bridge the gaps between the ends of adjacent segments and locate the two adjacent ends; the brackets being secured to the circular member.
- 85 7. A closure member according to claim 3 or any one of claims 4 to 6 when appended to claim 3, in which each arcuate segment has an inwardly directed flange with an aperture therein to receive the radially outer end of the respective rod.
- 90 8. A closure substantially as hereinbefore described and illustrated with reference to the accompanying drawings.

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